

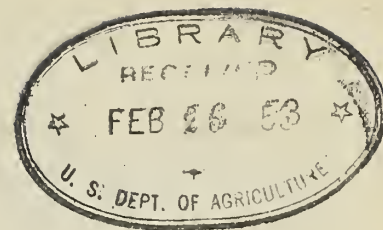
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UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SUMMARY REVIEW OF MONTHLY REPORTS¹
FOR
SOIL CONSERVATION SERVICE--RESEARCH²
JULY 1952



EROSION CONTROL PRACTICES DIVISION

Control Plot Experiments - F. W. Schaller, Ames, Iowa

"Some interesting developments are evident on the old control plots at Clarinda. Plots in corn for 21 consecutive years were given 180 pounds per acre of elemental nitrogen plus adequate phosphate when the corn was planted this year. Observations of the corn for height, vigor, and color now indicate that most of the trouble developed during this 21-year period which caused low yields has been largely eliminated. It appears likely that these plots will yield equal to the continuous rotation plots and to other plots in this experiment which have had better past management and received smaller applications of nitrogen this year."

Erosion Control Practices - G. R. Free, Ithaca, N. Y.

Contour and Up and Downhill (Marcellus) - "Yield benefits in favor of contouring ranging from 10 to 24 percent for cultivated crops and small grain have been reported in previous monthly and annual reports. These plots are on Honeoye silt loam, land capability class III, and have been in a 3-year rotation since 1942. The hay yields in previous years have been substantially the same under contour and up and downhill. This year the yield of first cutting hay on the contour plots was 2.27 tons per acre and 1.89 on the up and downhill plots (oven dry basis). The benefit from contouring amounted to nearly 21 percent. The annual rate of erosion from the up and downhill plots was determined a year or so ago by Mr. Bhagat and Professor Zerman and found to be about 12 tons per acre compared to a trace from the contour plots."

Soil Moisture at Marcellus - "This year we are using the electrical resistance of plaster of paris plugs placed in the soil to follow soil moisture. Installations have been made in triplicate at depths of 7-1/2, 15, and 30 inches under both corn and alfalfa. It was interesting to note that the 2-inch rain on July 9-10 affected readings at 7-1/2 and 15 inches under both crops. By the end of July moisture was at a low level down to 30 inches under alfalfa whereas there was a plentiful supply under corn at that depth and the latter crop was just beginning to draw to any extent upon moisture at 15 inches."

Plant Residues - O. W. Beale, Clemson, S. C.

"The amounts and distribution of plant residues in the soils tilled by different methods were determined in July after the last cultivation of the corn."

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Following a vetch and rye cover crop, the soil of the mulch-tilled treatment contained 9,374 pounds per acre of air-dry-plant residues greater than 2.00 mm. in size to a depth of 6 inches. More than 50 percent of these residues were in the 0-2-inch depth. The soil, where the land was prepared by the conventional turn-plowing method, contained a total of 6,907 pounds per acre of residues to the 6-inch depth. Approximately 40 percent of this was in the 0-2-inch depth. Where no cover crop was grown the soil contained a total of 4,186 pounds per acre of residues to the 6-inch depth.

"The 0-2-inch layer of soil from the mulch-tilled land contained 1 ton more residues than that of the turn-plowed surface soil and the 2-4-inch layer of the mulch-tilled soil about 1/4 ton more than the turn-plowed land. The rate of decomposition of the turn-under residue is considerably higher than that on the surface of the mulch-tilled land."

Effect of Drought on Crops - B. H. Hendrickson, Watkinsville, Ga.

"Corn yields appear to be reduced to 25 percent of a normal crop. In many rotations not adapted to the land class the corn is a total failure. Cotton yields appear to be reduced about 50 percent.

"Annual lespedeza seeded in small grain is almost a total failure; volunteer stands are fair to good. Good moisture will be necessary in order for annual lespedeza to produce a hay crop or make sufficient growth for seed harvest.

"Hay yields from alfalfa, fescue, and sericea have been reduced approximately 50 percent.

"Early planted grain sorghum will produce a good yield; late planted sorghum (after Caley peas and other winter legumes harvested for seed) will probably not make good yields due to the long drought when in seedling stage."

Tobacco Experiments - T. L. Copley, Raleigh, N. C.

"Distinct differences between treatments are showing up this year partially as a result of dry weather. Legume nitrogen has not become available and tobacco at the end of the month was showing no excess nitrogen effects; however, this may change with adequate rainfall. Where half the initial fertilizer nitrogen was omitted following legumes, tobacco growth is noticeably small after soybeans. Growth is normal and with good quality following crotonaria this year, while in previous years it showed excess nitrogen. This illustrates the hazards of following tobacco immediately after legumes. Neither the amount of nitrogen supplied nor the time it becomes available can be determined or controlled. Tobacco is doing best in the 2-year rotations with wheat-redtop, wheat-fescue, or wheat-weeds. Tobacco after both peanuts and cotton is good this year but is poor following corn. There are indications that meadow nematode or some other disease is giving trouble after corn.

"Tobacco in all the mulch-balk plots continues to look better than average and almost as good as the wheat-grass rotation. Crab grass is volunteering more heavily in these mulch-balk plots than in other treatments, which will further reduce erosion. Tobacco at this stage will hardly be affected by late crab grass."

Yields from Seeded Pastures - F. Rauzi, Laramie, Wyo.

"The 1950 seeded pastures at Archer were cut for hay during June. Yields from these pastures were higher than in 1951, and were as follows:

	Intermediate wheatgrass	Intermediate wheatgrass and alfalfa	Russian wildrye and alfalfa	Stiffhair wheatgrass and alfalfa	Crested wheatgrass and alfalfa
	<u>Lbs./acre</u>	<u>Lbs./acre</u>	<u>Lbs./acre</u>	<u>Lbs./acre</u>	<u>Lbs./acre</u>
1951	390	803	435	740	743
1952	750	880	518	923	850

"The alfalfa in the grass pastures did very well this year which may account for the increase."

Erosion Control Practices - D. D. Smith, Columbia, Mo.

Water Losses in Ponds - "The level of water in stock ponds is generally low. For the two ponds with water-level recorders at McCredie, the evaporation and seepage losses totaled about 21 inches during the last 3 months, or about three times the rainfall amount. No runoff has occurred during the period. The ponds were both at spillway level during the last week of April due to their favorable watershed-pond area ratio. Average per day losses for the two ponds are as follows:

	16-acre pond	1-acre pond
May	0.150 in./day	0.175 in./day
June	.231 in./day	.201 in./day
July	.318 in./day	.300 in./day
Total for 3 months	21.12 inches	20.73 inches

Supplemental Irrigation - "Corn in the supplemental-irrigation study was irrigated twice in July. First application was made on July 10, after a total rainfall of 0.98 inch in the preceding 18 days. The second irrigation was applied July 23. A total of 2.45 inches of water was added to the continuous corn plot and 2.24 inches to the rotation corn plot. The corn does not appear severely damaged by lack of water, but the much darker green color on the irrigated plots compared with the unirrigated indicates more efficient use of the high-level soil treatments applied where soil moisture is adequate.

"Production on pastures is being reduced by the dry weather and high temperatures. Bromegrass with Ladino clover, which carried 1.5 head per acre in July and August of 1951, carried only 0.5 head per acre this July, and cattle will have to be removed entirely unless substantial rain occurs shortly. Alta fescue is proving to be the most drought-resistant grass under study at the farm."

Effect of Supplemental Irrigation on Runoff-- G. D. Brill, New Brunswick, N. J.

"Since weather forecasts are not infallible, quite frequently a rain will occur immediately after an area has been irrigated. On July 21 we had a short, high intensity, thunder shower about 6 hours after an inch of water had been applied to our sweet corn plots on the Vegetable Research Farm at New Brunswick. Runoff from this storm is show in table 1.

Table 1.--Effect of rotations and supplemental irrigation on runoff during the storm of July 21, 1952

	<u>Not irrigated</u> <u>Inches runoff</u>	<u>Irrigated</u> <u>Inches runoff</u>
Continuous sweet corn	0.09	0.37
Sweet corn in rotation	.04	.19

Total rainfall for the storm - 0.66 inch.

Maximum intensity for 5-minute period - 3.84 inches per hour.

"The erosion hazard is much greater where supplemental irrigation is applied. Water loss from irrigated sweet corn was four times as high as from non-irrigated corn. Where corn is grown in rotation with a grass-legume sod, with the sod occurring every third year, the water loss was only half as much as from continuous corn."

Crop Rotations - C. J. Whitfield, Amarillo, Tex.

"Wheat yields on the rotation plots were below average this year. Precipitation from July 1, 1951, to June 30, 1952, amounted to 15.05 inches, as compared to the Amarillo Experiment Station's 13-year average of 18.88 inches. This amounts to a deficiency of 3.83 inches from wheat harvest in 1951 to wheat harvest in 1952. From August 1951 to March of 1952, precipitation was below average with May and June of 1952 also below average. The only months above average were July, March, and April. Because of the deficiency of fall moisture, wheat plants were slow in getting started and a poor root system developed.

"The highest yield was 17.75 bushels per acre from plots in a wheat-sorghum-fallow-grass rotation. The plots were in grass 6 years and then returned to the wheat-sorghum-fallow rotation. The 1952 crop was the second wheat crop following grass. The plots in a wheat-sorghum-fallow rotation without grass made a yield of 13.83 bushels per acre which is 3.92 bushels per acre less than the plots with grass in the rotation. Plots cropped continuously to wheat produced an average yield of 5.84 bushels per acre. Wheat yields in 1952 further emphasized the advantage of a crop rotation for producing consistant dependable yields. A 5 bushel crop will just about pay expenses of producing a crop."

Soil Permeability Analysis Procedure Revision - G. M. Horner, Pullman, Wash.

"A revision of the soil permeability analysis procedure for very slowly permeable samples has been giving satisfactory results. In numerous cases with the standard procedure, no percolate was caught after several days with a head of water

on the surface of the core. Since the base of the core remained wet, it was apparent that the permeability rate was not zero. Evaporation was sufficient to remove the water from the base as rapidly as percolation occurred.

"The revised technique consists of placing a water-tight cap on the top of the core in place of the 1-inch cylinder normally used. This cap is completely filled with water and is connected to a flask by means of a rubber tube. The flask contains a supply of water, and as water percolates into the soil, the water is replaced by that in the flask. The flask is stoppered so as to prevent evaporation. By periodical weighings of the flask, the successive losses of water represent the amount of percolation into the soil. The cores are completely saturated before the test is started, and the permeability rate is taken as the amount of water lost from the flask after the rate has become constant. Values obtained by this method range in magnitude from about 0.005 to 0.02 inch per hour."

Soil Erosion Practices - R. M. Smith, Temple, Tex.

"Our 104 steers averaged 801 pounds per head on July 29. Gains from July 1 to the 29th were 0.8 pound per head per day. Best results were obtained on sweet sudangrass where the daily gain was 1.4 pounds. Ten steers lost an average of 0.6 pound per head per day on rather mature, unfertilized K. R. bluestem, although they ate the grass satisfactorily. It seems likely that a lack of sufficient protein in the grass may account for the weight losses. Average gains of somewhat less than 1 pound per head per day on good stands of clover are probably related to the fact that the steers did not eat the clover well until they got used to it. This seemed to take about a week, and they may have lost weight during that time. All steers are still on grazing. The stocking rate has been reduced from about 2 steers per acre to 1 per acre on the sweet sudangrass, because the re-growth is now very slow. Nineteen have been put on permanent pasture of Bermudagrass, buffalograss, and minor species; and the others are all on clover, which is abundant but is partially wilted from drought. Preparations are being made for going into the feedlot as soon as corn is harvested and experimental rations are agreed upon.

"Flat breaking with the disk plow, and land preparation with a Dempster sub-surface plow are well under way. The Dempster tool does a good job of sub-surface, mulch plowing without serious trashing up from straw. One or more chiselings to loosen the ground are necessary before the plow, with its 30-inch sweeps, can be pulled in this clay soil at its present moisture content, which is within 2 percent of the permanent wilting percentage (pF-4.2) in most places. Also, we have found it necessary to remove one of the three sweeps before a 'Farmall M' can pull the plow in hard ground. Our mechanic, has been able to connect and adapt a 3-way hydraulic valve onto a Farmall in such a way that the Dempster plow can be put into the ground as well as lifted out, as is intended by its design. This is not possible with the standard hydraulic system of the Farmall M and some other common tractors. He has made other adjustments as required and is largely responsible for our being able to use the Dempster plow quite successfully."

Effect of a Rotation of Cotton, Wheat, and Sweet Clover - H. A. Daniel, Guthrie, Okla.

"The effect of a rotation of cotton, wheat, and sweet clover has been studied at the Red Plains Station during the past 22 years. It has reduced soil loss 74 percent and runoff water 34 percent annually, and increased the yield of seed cotton 37 percent as compared to continuous cotton. Both the wheat and sweet clover

greatly reduced erosion, but the amount of soil removed from the wheat plow was 6.0 times more than that from the sweet clover."

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio

"July rainfall in this areas was extremely spotty. Much of Ohio received less than an inch of rainfall. Station rainfall, however, was nearly normal - totaling 4.10 inches. Over three-fourths of this amount fell in three storms having excessive rates as shown in table 1.

Table 1.--Three largest storms in July

Date	Total rainfall	Maximum rates for--		
		2-min.	3-min.	5-min
	<u>Inches</u>	<u>In/hr.</u>	<u>In/hr.</u>	<u>In/hr.</u>
July 3	1.77	5.10	5.00	4.92
8	.52	4.80	3.80	3.12
16	.92	3.80	3.80	2.52

"Runoff rates and amounts as well as the erosion from the poor-practice watershed were quite large. Similar values from the conservation-practice watershed were much lower. Those from the mulch and the Krilium watersheds were almost zero. These results are summarized in table 2:

Table 2.--Runoff and erosion from small watersheds, July 1952

Date	Runoff from watersheds--				Erosion from watersheds--			
	106	121	188	191	106	121	188	191
	Poor	Conserv.	Mulch	Krilium	Poor	Conserv.	Mulch	Krilium
	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	<u>Lbs/A</u>	<u>Lbs/A</u>	<u>Lbs/A</u>	<u>Lbs/A</u>
July 3	0.76	0.41	0.04	0.01	8,370	2,220	58	20
" 8	.14	.05	0	0	1,200	242	0	0
" 16	.43	.25	.01	T	3,840	404	7	0
Total	1.33	.71	.05	.01	13,410	2,866	65	20

"It is obvious that both mulch culture and Krilium were effective in reducing runoff and soil loss.

"With only 0.57 inch rainfall during the last 15 days of July, soil-moisture supplies diminished to points near wilting."

Hydrologic Studies - J. A. Allis, Central Great Plains Experimental Watershed near Hastings, Nebr.

"In July we received 5.61 inches of rain at the Meteorological Station. The largest storm of the month occurred during the night of July 13-14, when 2.86 inches fell in less than 4-1/2 hours. About 1/2 inch fell in the hour and a half preceding 12:25 a. m. at which time 1.10 inches fell in the following 15-minute period and was followed by another 1-1/4 inches which fell from 12:40 a. m. to about 3:00 a. m. Other rains during the month were well distributed and were especially beneficial to the corn crop.

"It was interesting to note that during the 1-month period from the middle of June to the middle of July we received 9.28 inches of precipitation at the Meteorological Station.

"The two technical personnel and the farm foreman on the project made current-meter measurements at gaging stations W-3, W-8, and W-11 during the night of July 13-14. Watershed W-3 with 481 acres which is farmed by ordinary practices reached a peak of 644 c. f. s. or 1.33 inches per hour as compared to 274 c. f. s. or 0.66 inch per hour at W-5. W-5 has a drainage area of 411 acres and about 68 percent of the planned terraces have been built.

"On July 14 Watershed W-3 reached the second highest peak in the last 13 years of record only to be exceeded by the storm of July 10, 1951, when there was 853 c. f. s. or 1.76 inches per hour flowing. The peak on W-5 was exceeded 4 other times during the same period of record when the area was under a lesser amount of conservation practices.

"The maximum peak rates of runoff on July 14 from the small watersheds are not complete, however, the average peak rate was 4.06 inches per hour from corn straight row; 2.88 inches per hour from corn on the contour, and 3.20 inches per hour from subtilled corn."

Hydrologic Studies at R. B. Hickok, Lafayette, Ind. Etc.

"Rainfall of 8.9 inches at the Throckmorton Farm during June was more than twice the 'normal' and considerably higher than any June rainfall for Lafayette since 1902. Storms totaling 5.7 inches during the 3-day period, June 12 - 14 (highest reported in the State) resulted in high runoff losses from practically all of the experimental watersheds. However, rainfall intensities and consequently peak runoff rates, did not approach record values. A total of 2.4 inches of rainfall on June 21-22 also resulted in high runoff.

"Data compilations are not complete, but examination of the recorder charts indicates generally, substantially lower runoff amounts and rates from the conservation-treated than from the prevailing-treated watersheds. July rainfall totaled only 2.4 inches, which is significantly below 'normal,' and there was little runoff during the month. Serious drought reported in some parts of the State did not extend to this area.

"An unusual opportunity was afforded on our watersheds recently to study the effects of increased cover density resulting from conservation practices on evaporation from the soil surface. The results indicate an important effect on the efficiency of moisture consumption and hence the net effect of reduced runoff losses

on the conservation watersheds. Mr. N. L. Soltenberg has prepared the following report on this study:

"Greater crop growth should theoretically reduce evaporation losses due to shading and a decrease in air movements. In comparing our prevailing practice watersheds with those under a conservation treatment we have occasionally observed higher moisture contents at the surface on the conservation watersheds for some time after a rain. We have considered that the higher moisture content was due to reduced evaporation, but measurement of the amount was difficult due to differences in runoff or transpiration.

"The following data were obtained from watersheds in brown, mature wheat for a 15-day period, July 9 through July 24, 1952. We have assumed transpiration to be very low under these conditions and the difference in transpiration between the prevailing and conservation-practice watersheds to be negligible.

Table 1.--Losses due to evaporation, Purdue--Throckmorton Farm, July 9, 1952, through July 24, 1952

Watershed No.	Crop and practice	Loss* in upper foot inches of water
		<u>Inches</u>
5	Wheat--prevailing	2.33
6	Wheat--conservation	<u>1.65</u>
	Water saved due to reduced evaporation	0.68
8	Wheat--prevailing	2.07
7	Wheat--conservation	<u>1.40</u>
	Water saved due to reduced evaporation	.67

*Includes rains totaling 0.67 inch on watersheds 5 and 6, and 0.62 inch on watersheds 7 and 8, falling in four showers during period 7-14 through 7-16.

"Weather conditions during the period favored high rates of evaporation. Effects of the showers disappeared within a few days. The mean maximum temperature of 85° was about normal but relative humidity was low most of the time due to general movements of air in from the northwest.

"Three quarters of the water saved could be accounted for in the upper 6 inches but a slight reduction was measured in the 12-18-inch zone. It should be noted that the water saved by reduced evaporation due to greater crop growth in turn becomes available for greater crop growth."

Hydrologic Studies - G. A. Crabb, Jr., East Lansing, Mich.

"Total precipitation for May, June, and July has amounted to 8.27 inches at the cultivated watersheds. This is only 82 percent of the 10.03 inches normally expected during this period. Drought conditions reduced the soil-moisture percentages to a dangerously low point once in July, from which it has been partially

recharged. The soil is still quite dry to a depth of 24 inches.

"The program of analysis and publication of hydrologic data proceeded a little faster than usual in July. Further work was done on the presentation of the results of the soil-freezing experiments made in the laboratory this spring. Another technical paper, 'Insolation: a primary factor of evaporation in Michigan,' was completed and passed to a number of specialists for review. Their suggestions were incorporated in a revised version, and the completely rewritten paper submitted for clearance."

Runoff Studies - N. E. Minshall, Madison, Wis.

"Precipitation at Edwardsville, Ill., totaled 7.29 inches, which resulted in a surface runoff of 1.55 inches from watershed W-I. Temperatures varied from 96 degrees on the 28th (maximum) to 50 degrees on the 24th (minimum). Of the total precipitation, 4 inches occurred on July 2, which resulted in over 1-inch runoff from all watersheds. Data on this storm are given in the table below:"

Watershed No.	Drainage area <u>Acres</u>	<u>Rainfall intensities</u>			<u>Max. rate of</u>
		<u>Inches/hour</u>			<u>runoff</u>
		10 min.	20 min.	30 min.	<u>Inches/hour</u>
W-I	27.2	6.36	5.25	4.20	1.84
W-II	50	6.72	5.70	4.50	2.80
W-IV	290	6.60	5.67	4.62	1.68

Supplemental Irrigation - J. R. Carreker, Athens, Ga.

"Very high temperatures prevailed during the latter half of June and all of July. The highest at our plots on the University farm was 105° on July 24. There were 51 days during June and July with maximum readings of 90° or above. On June 25, 26, 27, 28, and 30, and July 21-28, inclusive, maximum readings were 100° and above.

"Rainfall totaled 4.48 inches in June and 1.84 inches in July. There were good rains during the period June 15-20, and 0.51 inch on June 28. No more rain of consequence fell until July 28. Showers on the 28th, 29th, and 30th of July totaled 1.39 inches.

"Evaporation during June was 7.04 inches, with 8.77 inches measured in July.

"The wind movement at the plots totaled 323 miles in June and 609 miles in July.

"Evapo-transpiration rates were extremely high due to the excessive temperatures. Soil-moisture measurements on the plots at the Watkinsville Station were as follows:

"June 12, 1.0 inch; June 25, 0.8 inch; July 3, 1.0 inch; July 10 and 11, 1.0 inch; July 15, 2.0 inches; July 22 and 23, 1.5 inches; July 26, 2.1 inches; total 9.4 inches. The quantity applied in the last three applications was

determined by the amount needed to restore the soil moisture to field capacity.

"All of the irrigated crops were in excellent condition. The unirrigated corn was nearly dead, not growing, and showing both potash and phosphorous nutrient deficiency. No such symptoms showed in the irrigated corn with the same fertilizer treatment.

"A boll and square count in the cotton on July 14 and July 30 showed the following results:

	Irrigated	Unirrigated
	Number of bolls and squares/plant	
July 14	32.4	22.7
July 30	29.9	7.7

"The irrigated cotton plants were 45 inches tall and the limbs were lapping in the middles. The unirrigated plants were 33 inches tall, but the limbs did not reach over half-way across the middles

Bean harvest was completed on July 28	The yield records were:
Irrigated	4,986 lbs/acre
Unirrigated	482 " "

"The irrigated beans were of good quality, but those unirrigated were not marketable because they were too small.

"The drought conditions were very severe and widespread over much of the Southeast. A feature article on the first page of the editorial section of the Atlanta Journal and Constitution Sunday edition August 3 was headed, 'All Georgians to Pay Heavy Price for Damage Brought on State's Crops by Crushing Drought.' Two excellent pictures showed the contrast between wilted corn in an unirrigated field and excellent corn that was irrigated. Excerpts from this story are: 'Drought--wilted Georgians--from the weary farmer in his parched fields of unyielding corn to his urban cousin in the steaming city--will pay and pay for the rains that did not come when needed.'

"For dry skies and record breaking June and July temperatures have brought the State its 'worst drought in 20 years.'

"The total loss will run into several hundred million dollars."

"Hardest hit--almost a knockout blow in some cases--is the producer, the State's farmer who looked to the skies in vain for rain to feed his drying fields of truck crops, row crops, and pasture grasses."

"The consumer, struck a softened blow but hurt just the same, is paying the toll in higher prices for food for his table."

Supplemental Irrigation - T. W. Edminster, Blacksburg, Va.

"The total rainfall for the month was approximately 2.79 inches, of which 1.44 inches occurred on July 30.

"The third application of 2 inches of water on the irrigated pasture lots was completed on July 23. Fourteen of the sixteen settings were covered on the fourth application before the rain on July 30. There is a great deal more herbage available on the irrigated lots than on the check lots. The carrying capacity of the check bluegrass and ladino lots has been greatly reduced, while on the irrigated bluegrass lots the carrying capacity has averaged one head to 0.67 of an acre. On the irrigated ladino-orchard lots of 2.6 acres, the carrying capacity has been approximately six head, or 2.31 head per acre.

"The Animal Husbandrymen says the gains of the 2-year old steers on the irrigated pastures at the end of July have been doubled as compared to the steers on the check lots."

Hydraulic Studies - F. W. Blaisdell, Minneapolis, Minn.

"Mr. Donnelly continued his check tests to determine if our new formula for the shape of the nappe was satisfactory. The results were satisfactory, so I developed a set of design curves for the solution of the nappe form both above the water surface and after it plunges below tailwater level. This curve is now being used to design spillways for testing purposes. The tests so far have shown it to be satisfactory. Mr. Donnelly has continued his check tests and for minimum widths of the outlet the design criteria which he has developed are proving satisfactory. At the end of the month the test channel was widened so that a spillway having a 60-foot width of crest, a 13-foot drop, and a 4-foot head over the crest could be tested. Tests, both with and without buttresses, have given results which are entirely satisfactory."

Hydraulic Studies - W. O. Ree, Stillwater, Oklahoma

"Testing was completed on the head-discharge characteristics of culverts equipped with weir sills. The tests covered rectangular culverts of depth-width ratios of 0.375, 0.5, 0.75, 1.0, 1.25, and 1.5. Slopes of 0, 1, 2, 4, 5, and 6 percent were tested. Flow conditions ranged from the lowest flows up to and including a part of the orifice flow range. These tests will cover the majority of rectangular culverts encountered in the field. The data are being analyzed and a final report being prepared.

"The report on the pipe-outlet experiments has been revised. The final report on this structure is now nearly complete.

"The second experiment on the combination grass-lined and concrete gutter channel was run. The first experiment was described in a preliminary report which has been distributed within the Service. During these earlier tests the grass cover was fair. However, at the time of the second set of tests the Bermuda grass had formed a dense turf up to and overhanging the gutter edges. Practically no scour occurred along the gutter edges despite the very high flow velocities in the gutter itself. The channel remained in excellent condition. The only scour noticed was near the cutoff walls on the gutter. This indicates the desirability of a redesign of these walls.

"A second trickle channel has been installed. This one has the center gutter lined with a fibreglas-asphalt prefabricated material which outwardly resembles roll roofing. The grassed portion of the channel has been planted to Bermuda grass.

Drainage Studies - M. H. Gallatin, Homestead, Fla.

"At the end of the month a check was made of the effect of the various treatments. It was found that CMU in both the 30- and 40-pound per acre application has given a better control of grass than TCA at 60 and 75 pounds per acre. The materials were applied on June 5 and on August 8; when the plots were checked it was noted that grass was beginning to grow in the TCA treated areas while in the plots treated with CMU this material still seems to be effective or it has completely killed out the plants.

"Ammate at the rate of 300 pounds per acre was sprayed on both walked down and standing willows. A check of the walked-down plot, even though water now covers the ground 2 to 6 inches deep showed 98 to 100 percent kill of all willow sprouts. On examination the wood seems to be turning brittle. Ammate at the rate of 300 pounds per acre was sprayed on a bay tree, examination of it on August 8 showed it completely dead and the wood turning brittle.

"Ammate at 200 pounds per acre and CMU at 40 pounds per acre was mixed and the weir pit sprayed with this mixture. All of the vegetation, weeds, grass, and brush were killed. A plot along the roadways with heavy cover of Bermuda, para, weeds, and brush was also sprayed and as of August 8, 98 to 100 percent kill of all growth was noted.

"This same mixture sprayed on the ditch killed growth on the banks but no effect was noted on bottom growth so two new plots were laid out and the areas dammed off. CMU dust was applied to the surface at the rate of 40 pounds per acre. Ten days to 2 weeks after application all bottom growth has been killed. The water in the treated area was quite shallow, 3 to 5 inches in depth.

"As a more effective control of grass and weeds was noted where the combination of CMU and Ammate was used a new series of plots was laid out and mixtures of Ammate and TCA and Ammate and CMU was applied on July 17. A preliminary check of these plots on August 8 indicated that the combination of CMU and Ammate to be more effective than TCA and Ammate.

"The sprayer used was designed and built at this office. It is a low pressure sprayer 30 to 35 pounds pressure with a very flexible arrangement of the boom. Our preliminary study shows that for low-growing grasses it is effective but for high thick weed and brush growth we do not get the volume or penetration for good kill. Also in spraying standing trees we would not get enough pressure to get good coverage.

"With this in mind a new sprayer is being designed to give a range in pressure from 30 to at least 150 pounds. From this past work a boom pressure of 60 pounds would give better penetration and for spraying standing willows, bay, etc., pressure somewhat higher would give better results."

Drainage Studies - T. W. Edminster, Blacksburg, Va.

"Mr. Walker reports that much thought has been given to the effectiveness of draw-down curves as a criteria for determining the degree of drainage under the soil conditions found in the Virginia Dare Soil Conservation District. Draw-down curve measurements have been taken from two locations in the districts where open ditches were the only means of artificial drainage. Draw-down-curves indicated

an appreciable change of the water-table pattern for as much as 80 feet in one case. But water ponded on the ground surface and the crop drowned at a distance of 20-25 feet. In many cases the surface layer has the lowest permeability as exemplified in the following data taken from the determination at Site No. VA-139, Bladen silt loam, Norfolk City Prison Farm:

<u>Depth of cores</u>	<u>Percolation rate</u> <u>inches per hour</u>	<u>Permeability</u> <u>code</u>
<u>Inches</u>		
2 - 5	0.11	2
9 - 14	2.62	5
24 - 27	.22	3

"The following points out both the need for adequate surface drainage of soils of this nature and the need of a criteria for measuring the effectiveness of a given drainage practice. At present, plans are being developed to sample, carefully, the crop grown and from this data compare the effectiveness of the different ditch spacings, depths, and slopes of land grading.

"Mr. Walker also reports that the field trip in the Mountain Soil Conservation District on July 29 and 30 was attended by J. G. Sutton, E. A. Schlautdt, R. C. Jones, and State and District personnel.

"The drainage problems are acute in this area. The principal crop in this area is pasture and hay. While the pasture can be obtained on the mountain slopes, the majority of the hay must come from the bottoms. A large portion of almost every bottom was wet or cut up into small tracts by poor drainage channels. The strictly wet areas appear to come from both surface and subsurface water.

"There was complete agreement in the group that the first step in the drainage of such land was to take off the surface water through dynamited ditches. Then the balance of the area could be drained through narrow, shallow (1.5 - 2.0 ft.) surface drains or deep (4 ft.) tile."

Sedimentation Studies - R. Woodburn, State College, Miss.

"The follow-up cross sections taken in June on lower East Goose Creek were calculated and plotted. A study was made of the changes in this channel since June 1951, when the original sections were taken.

"As was pointed out in July 1951, the record rain of that month knocked out several hundred feet of dike along the channel which permits the higher flows to spread across the bottom rather than to be confined.

"In spite of there being only a fraction of total watershed flow confined to the channel, there is evidence of some change in the channel since June 1951.

"The section studied was from station 0 + 00, the old Batesville Road bridge, north or downstream to station 32 + 70 where the distinct channel ends and a wide desanding area starts and from station 32 + 70 down the flat desanding area a distance of 955 feet to station 42 + 25 the end of the study.

Volume changes in these 4,225 feet during the last year were as follows:

<u>Station</u>	<u>Volume change - Cubic yards</u>	
0/50 to 32/70	Fill - 3,728	Cut - 1,659
32/70 to 42/25	Fill - 2,500	Cut - 2,107

"Careful interpretation is necessary to understand the changes which have taken place.

"From station 0/50 to 32/70, the 3,728 cubic yards of fill represent channel sand aggradation and the 1,659 cubic yards of cut mean bank cut or channel sloping, enlargement, etc.

"There is virtually no channel from 32/70 to 42/25 and some areas show apparent cut and others fill. The picture is not clear cut here with 2,500 cubic yards of fill and 2,107 cubic yards of cut. It was expected that there would be rather extensive areas of fill in this reach. The dike breaks which have reduced the amount of channel flow reaching this point have probably prevented more fill here.

"It is planned to re-survey these ranges annually for several years."

IRRIGATION ENGINEERING AND WATER CONSERVATION DIVISION

Firebaugh Drainage Investigation - W. W. Donnan, Los Angeles, Calif.

"Some time was spent in the field making the initial studies for the new drainage investigation in the Firebaugh Soil Conservation District, Fresno County. An Engineering Aid has been hired by Operations to make routine field observations and collect data. Thirty piezometer observation wells were installed adjacent to and out from tile lines in three locations where the effectiveness of drain is open to question. Borings have been made in these same areas to determine the nature and extent of various water-bearing aquifers. A water-level recorder was installed on one of the key wells to determine the daily and seasonal fluctuation in the deeper aquifers. All the electric power records for the 46,900 acres in the Soil Conservation District and the 166,860 acres adjacent to the District for the irrigation season 1950-51 were secured from the Pacific Gas and Electric Company. From these data and pump-test data, the total pumpage for irrigation purposes was computed. Monthly water scales made by the Firebaugh Canal Company, which services about 78 percent of the Soil Conservation District, have been compiled. It has been found that over a 12-month period (1950-51 crop year), the average delivery to the farm headgate has been 4.15 acre-feet per acre. Alfalfa, rice, cotton, and vegetables are grown in the area."

Water Conservation, Tehachapi SCD, Kern County, Calif.

"A provisional 'Progress Report on Irrigation and Water Supply Investigations in the Tehachapi Soil Conservation District, Kern County, California' by William W. Donnan and G. Marvin Litz was completed during the month. This typed report consists of about 90 pages of text and tables. The objectives of these investigations have been to make an inventory of the irrigation water supply for the Tehachapi Soil Conservation District and to determine the potential net safe yield of undeveloped surface and underground water for agricultural use within the District boundaries. Studies for the past 2 years indicate that the Sand Canyon and Cum-

mings-Brites Valley sub-basins of the District do not have an overdraft at the present time. In the Tehachapi Valley Sub-Basin there is a serious overdraft on the underground supply. This overdraft may approach 100 percent more than the average annual recharge. The present irrigation practices appear to be wasteful of water supplies. The trend toward increased acreage of high water-requirement crops presents a further complication in the conservation of the underground supplies of the Tehachapi Valley Sub-Basin. During the period 1946 to 1951 the extreme drought has been a major factor in the high water application for irrigation. The average depths of water applied per season for various crops were as follows:"

Potatoes	-52 inches	Beet seed	-72 inches
Alfalfa	-48 inches	Alfalfa seed	-48 inches
Irrigated pasture	-54 inches	Grass seed	-48 inches

Replenishment of Underground Aquifers, San Joaquin Valley, Calif. - L. Schiff, C. Johnson, and E. S. Bliss, Bakersfield, Calif.

L. Schiff and C. Johnson - "Test runs on the pumice and Krilium-treated 0.005-acre ponds are being continued. At present, the pumice pond seems to have passed its peak infiltration rate in S-shaped infiltration rate curve. This rate equaled or exceeded the original rate on this pond when it was first operated in the undisturbed state. However, rates after the initial run have been lower by a considerable amount. The pumice treatment combined with spading in this case had the effect of raising the rate to a point approximately the same as the initial rate of undisturbed soil on the first test run. Krilium treatment on Pond No. 19 definitely increased rates of that pond over other previous rates in that pond. Tests with Ultra-Wet were discontinued on July 18. The effect of adding Ultra-Wet in solution at the rate of 500 pounds per acre was to depress the rate from about 1.00 foot per day to about 0.50 foot per day. Previous additions of 50 pounds per acre gave no noticeable change in the infiltration rate as compared with untreated controls. The following table shows the effects of Krilium, pumice and Ultra-Wet treatments:

Elapsed time days	Infiltration rate in feet per day				
	Ponds (0.005 acre)			Infiltrimeters 9 inches in diam.	
	No treat- ment	Krilium	Pumice	No treat- ment	Ultra-Wet
1	2.2	2.2	2.3	1.2	1.4
7	3.1	3.6	2.6	.9	1.2
11	3.5	4.1	3.5	.9	1.1
15		5.4	4.7	.8	1.1
17			a5.8		
19		a7.6		.6	1.0
31				.6	1.0
32			6.2	.6	b .7
36		28.2	4.1	.5	.5
39				.6	.5
44			3.3		
46		9.8			

a. Between 17th and 36th days a few dry periods of short duration occurred owing to lack of water supply.

b. Added additional Ultra-Wet on basis of 500 pounds per acre."

E. S. Bliss - "As a result of low infiltration rates obtained in the recently prepared large spreading area at Poso and Rosedale ranches the North Kern Water Storage District requested this Division to prepare a program of treatments that might be expected to improve infiltration rates in the future. A detailed program was therefore prepared for each of these areas and has been tentatively approved by the district people. Included in these proposed programs are detailed plans for a trial on an extensive field scale of two treatments--Bermuda grass and Cotton-gin trash on the various soil types. Control (no treatment) basins are also to be used for comparative evaluation of the treatments. In addition the soil conditioner, Krillium, may be tried if the District people are able to obtain enough material for a 3-acre plot. It is believed that if this program is carried through the following benefits will be gained:

- A. Maximum amount of water spread during entire time of test.
- B. Determination of the practical value (from an infiltration standpoint) of several treatments that have benefited rates in the laboratory and in small field ponds.
- C. A basis for the determination of the economic feasibility of such treatments.
- D. A basis for comparison of the relative value of the treatments both from the standpoint of infiltration and economics."

Replenishment of Underground Aquifers, Ventura County, Calif. - D. C. Muckel and L. Schiff, Calif.

"A conference in Ventura, representatives of the California Division of Water Resources pointed out areas in Zone 3 of the Ventura County Flood Control District where well logs, ground-water level fluctuations, and geologic formations indicated probable success with artificial recharging of the ground-water supplies. The tentative location of a proposed pipe line to import water was also shown. With this information, this Division can now concentrate its studies of surface soils in those areas where other conditions will lend themselves to artificial recharge. During the month eight infiltrometers equipped with supply tanks and float valves were installed for long-time continuous runs. It is interesting to note that the typical S-shaped curve found at Bakersfield is also being obtained in Ventura County, even though the infiltration rates differ widely. At one location in Ventura County infiltration rates of more than 50 feet per day have been observed. This is on an outcrop of aquifer material which kips under the valley floor and which is penetrated by many pumping wells. Unfortunately topography is against any large scale spreading in this particular area."

Drainage Investigations - G. B. Bradshaw, Boise, Idaho

"A study of alkali reclamation in conjunction with a drainage investigation is being conducted in Gem County. Irrigation, drainage, and artesian waters are being applied to highly alkaline soils having various applications of 0, 5, and 10 tons of gypsum per acre. The irrigation, drainage, and artesian waters contain various concentrations of soluble salts, sodium, and gypsum. These various concentrations have an effect upon the infiltration rate and the reclamation effect of the various leaching waters.

"The ionic analysis of the three leaching waters applied are as follows:

No.	E.C. x10 ⁶ 25°C	Anions m. e./l				Catons		m. e./l		Percent Sodium
		CO ₃	HCO ₃	Cl	SO ₄	Ca	Mg	Na	K	
1	119	0.00	0.91	0.03	0.78	0.48	0.16	0.45	0.06	39.1
2	645	0.00	4.36	.46	2.00	1.69	.63	3.84	.14	61.9
3	445	0.00	2.97	.44	1.17	2.73	.17	1.47	.04	33.3

1. Irrigation water
2. Drainage water
3. Artesian water

"The results of three replicates following the application of 1 foot of leaching water to each test area are given in the following table:

Summary of three leaching replicates on highly Alkaline soil

Item	Gypsum concentrations		
	None	5 tons/acre	10 tons/acre
<u>Irrigation water</u>			
1. Initial intake rate in./hr.	0.50	0.71	0.65
2. Final intake rate in./hr.	.02	.11	.34
3. Initial pH	9.6	9.4	9.3
4. Final pH	9.0	8.6	8.3
5. Pentrometer tests lb.sq.in.	1,833	1,630	1,446
<u>Drainage water</u>			
1. Initial intake rate in./hr.	0.49	0.66	0.93
2. Final intake rate in./hr.	.03	.12	.18
3. Initial pH	9.2	9.6	9.5
4. Final pH	9.1	8.7	8.3
5. Pentrometer test lb. sq.in.	1,772	1,609	1,487
<u>Artesian water</u>			
1. Initial intake rate in./hr.	0.52	0.76	0.71
2. Final intake rate in./hr.	.09	.27	.27
3. Initial pH	9.6	9.6	9.6
4. Final pH	8.8	8.4	8.3
5. Pentrometer test lb.sq.in.	1589	1222	1126

"Results to date indicate the artesian water gives better over-all reclamation results than either the regular irrigation or drainage waters. The higher calcium content and resultant lower percent of sodium makes it the better reclamation water for use on the highly alkaline land in Gem County.

"An artesian aquifer underlies the water logged, alkaline soils and is the major contributor to the drainage problem. The artesian water will be a by-product of the drainage program and the tests show it can be used for reclamation and irrigation."

Black Canyon Irrigation Investigation - S. Davis, Boise, Idaho

"The clover on the Black Canyon plots was irrigated twice during July. The final irrigation will be finished the first part of August and the clover will be left for seed.

"Sixty ring-intake tests were run on the slick spot and mixed slick spots soils having various treatments. The following table shows the results:"

<u>Area</u>	<u>Treatment</u>	<u>Intake rate</u> In./hr.
1. Slick Spot Soils	Check	0.01
Slick Spot Soils	10 tons/acre gypsum	.08
Slick Spot Soils	20 tons/acre gypsum	.18
2. Normal Soils	Check	.19
Normal Soils	10 tons/acre gypsum	.35
Normal Soils	20 tons/acre gypsum	.35
3. Slick Spot	Check	.01
Slick Spot	Mixed by hand shovel to 4 ft.	.30
4. Slick Spot	Check	.02
Slick Spot	Mixed to 30 inches by carryall	.15

10/2/52